

AMENDMENT

(Amendment under Article 11)

To: Patent Office Examiner

1. Indication of International Application: PCT/JP2004/009653

2. Applicant

Name	UBE INDUSTRIES, LTD.
Address	1978-96, Oaza Kogushi, Ube-shi, Yamaguchi, 755-8633 Japan
Nationality	Japanese
Address	Japan

3. Agent

Name: WATANABE Kazuhira, Patent Attorney (8861)  
Address: 3rd Fl., No.8 Kikuboshi Tower Building, 20-18,  
Asakusabashi 3-chome, Taito-ku, Tokyo  
111-0053 Japan

4. Object of amendment: Claims

5. Content of amendment

(1) In claim 1, in page 23 (English text Page 33), amend "A crystalline polymer exhibiting reversible crystal transition phenomenon in the solid phase state at a crystal transition temperature (Ttr) of 0°C to 67°C (67°C > Ttr > 0°C) and satisfying the relationship defined by the following formula (1):

$$150 > \Delta H_{tr} > 1.6T_{tr} - 3.5 \quad (1)$$

wherein  $\Delta H_{tr}$  represents the endotherm (J/g) accompanying crystal transition and Ttr represents the crystal transition temperature (°C)." to read --A crystalline polymer exhibiting reversible crystal transition phenomenon in the solid phase state at a crystal

transition temperature ( $T_{tr}$ ) of  $20^{\circ}\text{C}$  to  $60^{\circ}\text{C}$  ( $60^{\circ}\text{C} \geq T_{tr} \geq 20^{\circ}\text{C}$ ) and satisfying the relationship defined by the following formula (1):

$$150 > \Delta H_{tr} > 1.6T_{tr} - 3.5 \quad (1)$$

wherein  $\Delta H_{tr}$  represents an endotherm (J/g) accompanying crystal transition and  $T_{tr}$  represents the crystal transition temperature ( $^{\circ}\text{C}$ ).--

(2) In claim 2, in page 23 (English text Page 33), amend “A crystalline polymer exhibiting reversible crystal transition phenomenon in the solid phase state at a crystal transition temperature ( $T_{tr}$ ) of  $0^{\circ}\text{C}$  to  $67^{\circ}\text{C}$  ( $67^{\circ}\text{C} > T_{tr} > 0^{\circ}\text{C}$ ), having a weight average molecular weight of 600,000 or less, and satisfying the relationship defined by the following formula (2):

$$150 > \Delta H_{tr} > 1.6T_{tr} - 15 \quad (2)''$$

to read --The crystalline polymer according to claim 1, having a weight average molecular weight of 600,000 or less and satisfying the relationship defined by the following formula (2):

$$150 > \Delta H_{tr} > 1.6T_{tr} - 15 \quad (2)--$$

(3) In claim 4, in page 23 (English text Page 33), amend “The crystalline polymer according to any one of claims 1 to 3, wherein the polymer is a modified polybutadiene.” to read --The crystalline polymer according to any one of claims 1 to 3, wherein the polymer is a modified polybutadiene.--

\* Translator’s remarks: There is an error in Chinese character in the original document, but “modified polybutadiene” is the only way of translating the words.

(4) In claim 5, in page 23 (English text Page 33), amend “The crystalline

polymer according to any one of claims 1 to 4, wherein the raw polymer of the modified polymer contains 97 mol% or more trans-1,4-structure.” to read --The crystalline polymer according to any one of claims 1 to 4 and 19, wherein the raw polymer of the modified polymer contains 97 mol% or more trans-1,4-structure.--

(5) In claim 6, in page 23 (English text Page 34), amend “The crystalline polymer according to any one of claims 1 to 3, wherein the polymer has a melting point (T<sub>m</sub>) of 100°C or more.” to read --The crystalline polymer according to any one of claims 1 to 5 and 19, wherein the polymer has a melting point (T<sub>m</sub>) of 100°C or more.--

(6) In claim 8, in page 23 (English text Page 34), amend “The thermoresponsive board according to claim 7, wherein the material exhibiting reversible crystal transition accompanied by a volume change is trans-1,4-polybutadiene with a trans-1,4-bond content of 90% or more.” to read --The thermoresponsive board according to claim 7, wherein the material exhibiting reversible crystal transition accompanied by a volume change is trans-1,4-polybutadiene with a trans-1,4-bond content of 90% or more.--

(7) In claim 9, in page 23 (English text Page 34), amend “The thermoresponsive board according to claim 7, wherein the material exhibiting reversible crystal transition accompanied by a volume change is the crystalline polymer any one of claims 1-6.” to read --The thermoresponsive board according to claim 7, wherein the material exhibiting reversible crystal transition accompanied by a volume change is the crystalline polymer any one of claims 1 to 6 and 19.--

(8) In claim 11, in pages 23 and 24 (English text Page 34), amend “The thermoresponsive board according to claim 9, wherein the material exhibiting reversible

crystal transition accompanied by a volume change is prepared by forming a film of the crystalline polymer according to any one of claims 1 to 6 by applying a homogeneous solution of the crystalline polymer to one side of a substrate.” to read --The thermoresponsive board according to claim 9, wherein the material exhibiting reversible crystal transition accompanied by a volume change is prepared by forming a film of the crystalline polymer according to any one of claims 1 to 6 and 19 by applying a homogeneous solution of the crystalline polymer to one side of a substrate.--

(9) In claim 15, in page 24 (English text Page 35), amend “The thermoresponsive switch according to claim 14, wherein the crystalline polymer is the polymer according to any one of claims 1 to 6.” to read --The thermoresponsive switch according to claim 14, wherein the crystalline polymer is the polymer according to any one of claims 1 to 6 and 19.--

(10) In claim 17, in page 24 (English text Page 35), amend “A thermal storage material and a thermal storage medium comprising the crystalline polymer according to any one of claims 1 to 6.” to read --A thermal storage material and a thermal storage medium comprising the crystalline polymer according to any one of claims 1 to 6 and 19.--

(11) Add claim 19 to the bottom of the claims in page 24 (English text Page 35) as follows.

--19. The crystalline polymer according to claim 4, wherein the modified polybutadiene is an epoxy-modified polybutadiene.--

## 6. List of Appended Documents

(1) Claims, pages 23 and 24 (English text: Pages 33 to 35)

## CLAIMS

1. (Amended) A crystalline polymer exhibiting reversible crystal transition phenomenon in the solid phase state at a crystal transition temperature (Ttr) of 20°C to 60°C ( $60^{\circ}\text{C} \geq \text{Ttr} \geq 20^{\circ}\text{C}$ ) and satisfying the relationship defined by the following formula (1):

$$150 > \Delta H_{\text{tr}} > 1.6\text{Ttr} - 3.5 \quad (1)$$

wherein  $\Delta H_{\text{tr}}$  represents the endotherm (J/g) accompanying crystal transition and Ttr represents the crystal transition temperature (°C).

2. (Amended) The crystalline polymer according to claim 1, having a weight average molecular weight of 600,000 or less and satisfying the relationship defined by the following formula (2):

$$150 > \Delta H_{\text{tr}} > 1.6\text{Ttr} - 15 \quad (2)$$

3. The crystalline polymer according to claim 1 or claim 2, which is a copolymer of butadiene and an olefin.

4. (Amended) The crystalline polymer according to any one of claims 1 to 3, wherein the polymer is a modified polybutadiene.

5. (Amended) The crystalline polymer according to any one of claims 1 to 4 and 19, wherein the raw polymer of the modified polymer contains 97 mol% or more trans-1,4-form structure.

6. (Amended) The crystalline polymer according to any one of claims 1 to 5 and 19, wherein the polymer has a melting point ( $T_m$ ) of 100°C or more.

7. A thermoresponsive board comprising a flexible substrate and a layer of a material exhibiting reversible crystal transition accompanied by volume change provided on one side of a substrate.

8. (Amended) The thermoresponsive board according to claim 7, wherein the material exhibiting reversible crystal transition accompanied by a volume change is trans-1,4-polybutadiene with a trans-1,4-bond content of 90% or more.

9. (Amended) The thermoresponsive board according to claim 7, wherein the material exhibiting reversible crystal transition accompanied by a volume change is the crystalline polymer any one of claims 1 to 6 and 19.

10. The thermoresponsive board according to claim 8, wherein the material exhibiting reversible crystal transition accompanied by a volume change is prepared by forming a film of trans-1,4-polybutadiene by applying a homogeneous solution of the trans-1,4-polybutadiene to one side of a substrate.

11. (Amended) The thermoresponsive board according to claim 9, wherein the material exhibiting reversible crystal transition accompanied by a volume change is prepared by forming a film of the crystalline polymer according to any one of claims 1 to 6 and 19 by applying a homogeneous solution of the crystalline polymer to one side of a substrate.

12. The thermoresponsive board according to any one of claims 7, 8, and 10,

wherein the surface of the substrate has a porous structure.

13. An overheat-protection element comprising the thermoresponsive board according to any one of claims 7 to 12.

5

14. A thermoresponsive switch comprising a pair of electrodes, and an insulating component made of the crystalline polymer exhibiting crystal transition in the solid phase state and a component made of a conductive substance provided between the pair of electrodes, the electric connection and disconnection between the pair of electrodes  
10 being caused by change of volume expansion rate of the crystalline polymer when the polymer exhibits transition in the solid phase state near the crystal transition temperature range.

15. (Amended) The thermoresponsive switch according to claim 14, wherein the  
15 crystalline polymer is the polymer according to any one of claims 1 to 6 and 19.

16. The thermoresponsive switch according to claim 14, wherein the conductive substance is a metal.

20 17. (Amended) A thermal storage material and a thermal storage medium comprising the crystalline polymer according to any one of claims 1 to 6 and 19.

18. A method for heating the thermal storage material and thermal storage medium according to claim 17, characterized by using a microwave.

25

19. (Added) The crystalline polymer according to claim 4, wherein the modified polybutadiene is an epoxy-modified polybutadiene.